

➤ EXPLAIN ANALOG & DIGITAL SIGNAL.

Analog Data

Analog data refers to information which is continuous.

For Example, an Analog clock which is having hour, minute, and second hands that gives information in a continuous form; the movement of the hands are continuous.

Digital Data

Digital data refers to information which has discrete states.

For Example, a digital clock which reports the hours and minutes that will change suddenly from 10:05 to 10:06.

In this way the data can represent, signals can also represent either Analog or digital.

What is Analog Signal?

An Analog signal is a signal which is continuous and has a time-varying feature. It is a representation of time-varying quantity. For example, the Human voice can be considered an analog signal because the signal of the human voice flows in a continuous manner.

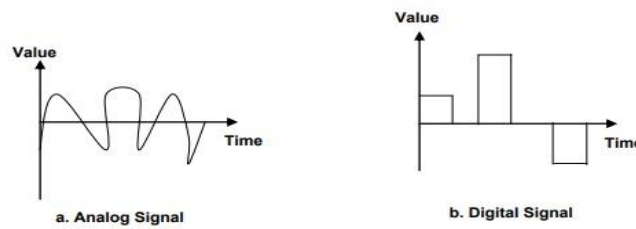
In other words, we can say that the analog signal is represented by the continuous variable which transmits the information/data as a response to physical phenomenon. It is known as an “Analog Signal”

Examples of digital signals are Temperature, Pressure, Flow Measurement, etc.

What is Digital Signal?

Digital signals can have only a limited number of defined values. Although each value can be any number, it is often as simple as 0 or 1.

The easiest way to show signals is by plotting them on a pair of perpendicular axes.



The above figure shows the Analog signal and a digital signal. The curve represents the Analog signal through an infinite number of points. The vertical lines of the digital signal, however, demonstrate the sudden jump that the signal makes from value to value.

Examples of digital signals are Motor, Digital Phones, Digital pens, etc

➤ EXPLAIN PERIODIC ANALOG SIGNALS

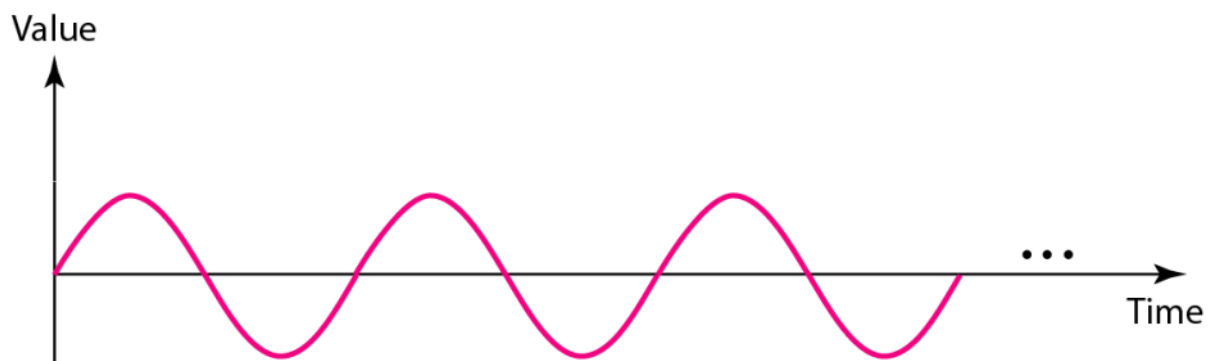
Periodic analog signals can be classified as simple or composite. A simple periodic analog signal, a sine wave, cannot be decomposed into simpler signals. A composite periodic analog signal is composed of multiple sine waves.

Sine Wave

The sine waves are the most fundamental form of a periodic analog signal.

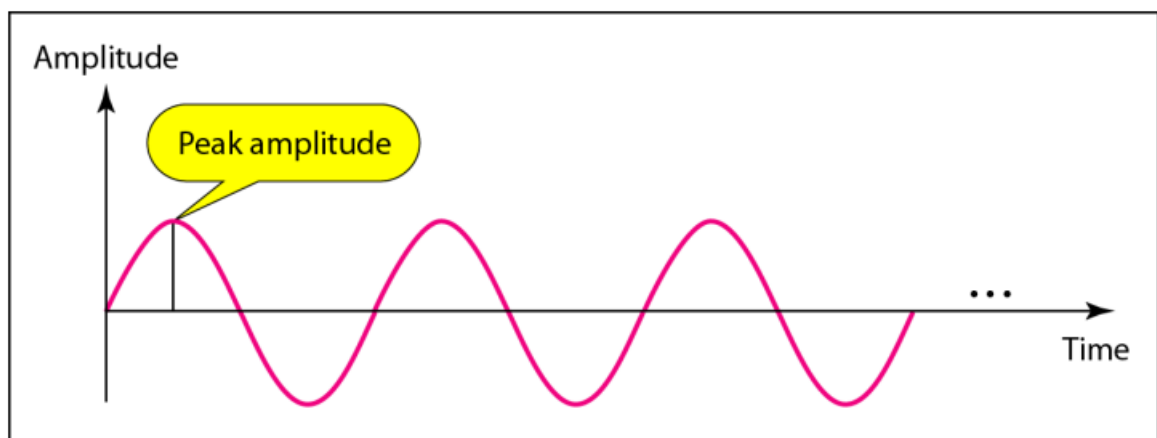
Sine wave can be fully describing by three characteristics.

Peak amplitude, period or frequency and phase.



Peak Amplitude:-

The peak amplitude of a signal is the absolute value of its highest intensity, proportional to the energy it carries. For electric signals, peak amplitude is normally measured in volts.



Period and Frequency: -

Period: is the amount of time (in seconds) it takes a signal to complete one cycle.

Frequency: is the number of cycle per second.

Frequency and period are the inverse of each other.

$$f = \frac{1}{T} \quad \text{and} \quad T = \frac{1}{f}$$

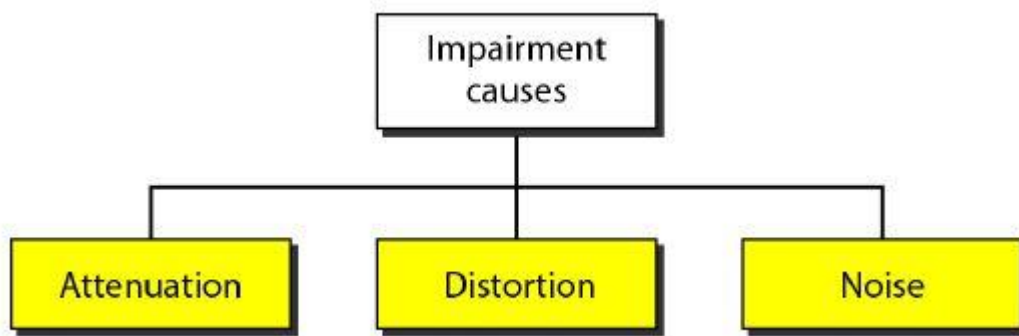
Frequency is expressed in Hertz (Hz).

Period is expressed in seconds.

➤ EXPLAIN TRANSMISSION IMPAIRMENT.

In communication system, analog signals travel through transmission media, which tends to deteriorate the quality of analog signal, which means that the signal at the beginning of the medium is not the same as the signal at the end of the medium.

Signals travel through transmission media, which are not perfect. The imperfection causes signal impairment. This means that the signal at the beginning of the medium is not the same as the signal at the end of the medium. What is sent is not what is received. Three causes of impairment are attenuation, distortion, and noise.



ATTENUATION

Attenuation means a loss of energy.

When a signal, simple or composite, travels through a medium, it loses some of its energy in overcoming the resistance of the medium. That is why a wire carrying electric signals gets warm.

To compensate for this loss, amplifiers are used to amplify the signal.

To show that a signal has lost or gained strength, engineers use the unit of the decibel.

The decibel (dB) measures the relative strengths of two signals or one signal at two different points.

The decibel is negative if a signal is attenuated and positive if a signal is amplified.

DISTORTION

Distortion means that the signal changes its form or shape.

Distortion can occur in a composite signal made of different frequencies.

Each signal component has its own propagation speed through a medium and, therefore, its own delay in arriving at the final destination. Differences in delay may create a difference in phase.

The shape of the composite signal is therefore not the same.

NOISE

Noise is another cause of impairment.

Several types of noise, such as thermal noise, induced noise, cross-talk, and impulse noise, may corrupt the signal.